INSTRUCTIONS

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PLAIN INSTRUCTIO

TO PREPARE AND PRESERVE FROM THE

RUST,

TEEL,

WROUGHT AND CAST IRON & STEEL,

LIKEWISE THE METHOD TO COVER

IRON WITH A SURFACE OF COPPER,

LIKEWISE THE METHOD TO MAKE AND PREPARE

THE GALVANIC POWDER AND PAINT,

By GEORGE JOHNSON,
FORMERLY FREE MERCHANT OF CALCUTTA.

NEW YORK:
PRINTED AND PUBLISHED FOR THE PROPRIETOR
BY W. B. & T. SMITH,
89 Nassau, and 128 Fulton-sts.
1842.

ERRATA.

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do do line 7, read, that are not lined.
do do line 30, *read, even if it is employed, &c.*

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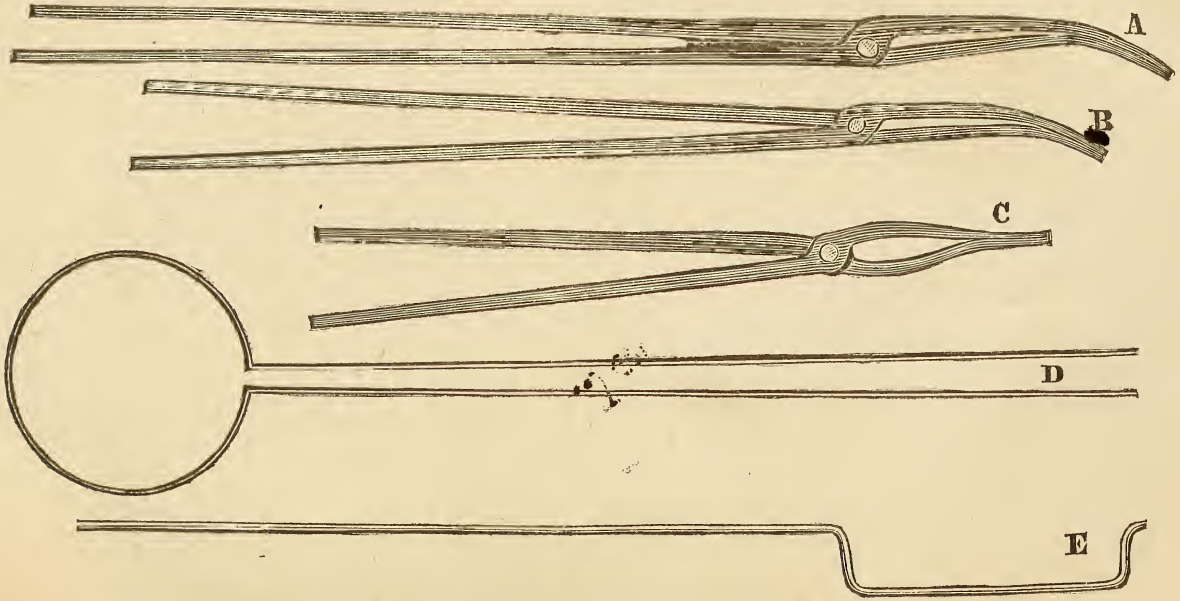


For Explanation, see page 8.

PREFACE.

To my friends the public, before the great public, I present myself with homage and respect; and my object for so doing, is to give them information upon a subject which is of immense importance to their interests.

To say, that I am going to discourse upon the preservation from Rust, of Iron, Cast Iron and Steel, is to say a great deal; to say Iron, Cast Iron and Steel can at a very small expense be rendered Rust proof, is to speak volumes to every practical and reflecting mind; yet such is the fact, and I am going to prove it. After more than four years experience and observation in this business in Paris, France, I will relate my views in a plain, unvarnished manner. First, then, I think nearly every article of Iron, Cast Iron and Steel ought to be galvanised; and for the simple reason that it costs so little to do it, and yet when well done it is done for ever; one cent per pound is all they charge in Paris for galvanising articles brought to them, when these articles are of any considerable weight, such for example as pipes for stoves, water pails, locks, spring wire for seats, &c. But before I proceed any further I will state the reason why it costs so little to galvanise, otherwise to zinc Iron, &c. I claim the merit and honor of being the first individual that ever promulgated in this country the knowledge, that sulphuric acid, that has been made use of for refining oils, is the article they use in Paris since about three years, to cleanse the oxyde of the metals, and that it actually answers better than sulphuric acid that costs so much money; it is after the oil refiner has done with it for his use, so that he is glad to be rid of it for nothing; this is precisely the article that does so well to cleanse the oxyde of the metals, thereby replacing an article that costs a great deal, by another which costs simply the carriage of bringing it to the manufactory where it is wanted: this is the first important economy in galvanising Iron: the second is that instead of using sal-ammoniac, which is a very expensive article in the items of galvanising, on account of the very great quantity necessary to be employed; they use in Paris since about three years the coarsest kind of muriatic salt otherwise called muriate d' ammoniaque or sel non sublimé, which does not cost but about half the former in the first instance, and lasts much longer being a stronger bodied article; the economy effected upon these two important articles, reduces the price of galvanising as before stated to one cent per pound.

Rosin, lamp oil and other substances have been tried in Paris to endeavor to economise upon this muriate d' ammoniaque or sel non sublimé, but nothing as yet has been discovered to succeed so well; it is absolutely necessary whilst galvanising for the zinc to be well and entirely covered with this salt, to prevent it from oxydising.

To such an extent is this idea of galvanising or zincing every article carried in Paris; that they even galvanise a course kind of wire work or wire cloth, which is there employed in the place of laths for partition walls: the plaster will adhere readily to it, and besides the advantage of not being scarcely any more expense than laths in the first instance; it will endure fifty times as long; takes up less room; and will not burn as laths do in the unfortunate event of a fire; the finer kinds of wire cloth adapted for sieves in the place of horse hair cloth, answers admirably, is a hundred times more economical than horse hair cloth for this purpose, and the first cost is very little more; this article is likewise galvanised to a great extent at Paris.

I will notice in this place, that the article which will probably be considered of the most importance; is Sheet Iron destined either for sheathing of vessels in the place of copper; or for roofing of every kind; for sheathing of ships, the first cost will not probably be more than a third; and will endure longer than copper, being harder than it: for roofing it is equally important, and equally economical; and this naturally leads me to describe the best method of preparing these sheets of Iron, so that they may not be rendered brittle and unfit for use: after cleansing the oxyde of the surface of the

sheets of Iron by means of the acids diluted with water: See Instructions: we arrive at the extremely important point of dipping the sheets of Iron in the melted zinc: the true art of galvanising these sheets of Iron, being thoroughly cleansed previously from the oxyde: is to have the zinc bath as hot as possible, and well covered with the muriatic salt; and as the salt consumes as much more rapidly, as the zinc is more intensely heated; it is necessary to have a pailfull of the salt close at hand; so that the workman may be able to throw on the surface of the zinc fresh salt as often as he perceives it is required, let there be no stint of muriatic salt if you wish to do the articles well; the workman dips the sheet of Iron, which he holds by the pincers A. See Engraving: into the zinc bath, quick, briskly; leaves it in for a quarter of a minute or so, balances the sheet in the prongs of the pincers, which he moves to prevent any trace of the pincers being left on the sheet of Iron, then draws out the sheet slowly, and hands it over to another workman who is placed on the opposite side of the bath to him; this second workman will take the sheet of Iron after being very particular to dip the edge of the sheet into the flux or muriatic salt which must always well cover the zinc, he will carry it, and stand it on its edge on a wooden frame made on purpose to contain them: here, my worthy readers will please to remark, the sheet of Iron has not yet touched the water, either warm or cold; and I particularly recommend to all those who wish to have good malleable sheets of Iron not to be too hasty in plunging the sheets into water, it is better for the toughness and malleability of the Iron to leave it to become cooler (say about from 5 to 10 minutes) than it is when it quits the zinc bath, before attempting to wash off the blackish stains caused by the muriatic salt: this is the method now adopted at Paris, and found to answer perfectly well; for if a man understands his business, the metals so far from being rendered brittle in galvanising them, are in reality, more tough and malleable: for a great length of time this same method of plunging nails into water immediately they came out of the zinc was adopted; but now it is found much better instead of scattering them into a tub of water, to scatter them upon the ground, and when they have become cool to put them into a barrel turning on an axletree with some water and coarse sand to wash them clean: it takes about 15 minutes to cleanse them.

It is necessary to skim the muriatic salt of the zinc, each time the workmen go to their meals to economise it; and to skim the oxyde of the zinc before again commencing, and previously to again putting the muriatic salt on the bath: these skimmings and the dross deposited at the bottom of the zinc bath, serve to make the galvanic paint powder: it is well each time the workman adds fresh muriatic salt to mix it, by stirring it up with the old.

All articles such as wire work, and to which the muriatic salt will adhere when they draw them out of the zinc; it would be well to gently beat these articles with an iron rod to knock off the excess of muriatic salt into the bath, which otherwise would be wasted, when the articles are plunged into the water.

Unless the articles are quite hot it is necessary to immerse them in the zinc bath quite slowly to prevent an explosion, and to draw them out again very slowly to prevent the zinc from forming into lumps at the ends; then again if they are small articles to give them a brisk shake, *i.e.* let the arm fall quick, and bring it back in turning up the arm to prevent the zinc from filling up the teeth of any article such as a curry comb.

In drawing out the curry combs, it is necessary to draw them out but a little, before laying hold of them with the pincers C. See Engraving: incline the object a little, so that the zinc may run down the object, instead of leaving a lump or bit at the end.

It is very important to bear in mind, that all articles, with which it is practical should be turned immediately they are taken out of the bath of zinc, to prevent the zinc from forming into lumps at the end of the article.

It is better as often as you have occasion to draw an article out of the zinc, to push up the muriatic salt to the edge of the article.

See Engraving: letter E. for form of the iron rod made use of for dipping the iron wire; the wire is made to turn on this rod in immersing it in the zinc, and also when it is drawn out of the Bath, and likewise in the Tub of water: For another form See Engraving: letter D. This form is made use off when you have Wire-work worked into sheets to be galvanised it is simply necessary to pass one end of the Handle through any part of the Wire-work that is most convenient, and to slip it along the handle until it arrives in the circle; these rods are formed out of wrought Iron, one quarter of an inch in diameter, and about four feet in length.

In galvanising Nails; the iron basket into which you put them should be previously immersed in the zinc, then put about four pounds of Nails at one time into the basket, and cover them well all over with the muriatic salt; stir them up with an instrument made for the purpose in the form of a small spade, leave them say about a minute in the Bath; and when you draw the basket out of the zinc shake it well to eject as much as possible the excess of zinc into the Bath, afterwards take it away, and keep shaking it all the time you scatter the Nails upon the ground.

It is necessary for the articles to be warmed before you galvanise them, otherwise they will not take well the zinc.

The most difficult article to galvanise is spring Wire made use of for seats of Sofas &c. it requires to be pulled in and out to prevent the zinc from soldering it; and requires to be well beaten to prevent an excess of zinc from forming on the surface.

It is well before commencing to use a fresh tool to take the precaution of dipping it in the zinc: by drawing the article out of the bath slowly it gives time for the zinc to run down and so not to form into lumps at the end: In galvanising all articles such as Pails &c. it is necessary to turn them round and round in the zinc that it may be as smooth as possible: in galvanising plain sheets of wire-work, the muriatic salt is very apt to fill up the meshes; it is necessary to be well beaten in drawing it out of the Bath, and it is more ecomical to have a sheet of Iron under the part where you draw it out, to be able to catch all the muriatic salt ejected by the beating.

In galvanising an article like the barrel of a drum, first dip it in the bath horizontally; then turn it upside down and hand it over to the workman placed opposite; and on no account forget to turn up the article the reverse way when it is out of the bath for the reason before stated.

When working on a large scale put the zinc into the bath over night, whenever your bath wants replenishing.

It is necessary to cleanse the wire work from the stains caused by the muriatic salt in the same manner as the other articles by washing them with a brush and water.

When it is necessary to galvanise long folds of wire work, too long for the depth of the bath, it is sufficient to galvanise the half first, taking care to beat it well to eject the excess of muriatic acid and zinc; they plunge it in warm water, and finish by doing the other half in the same manner.

The time each article must remain in the zinc bath depends upon the nature, and bulk of the article, whilst the article is of a slight form a shorter time is necessary, than if the article was of a great bulk and substance.

In galvanising Iron sieves they should be immersed in the zinc horizontally so as to allow the muriatic salt to penetrate slowly through the meshes of the wire.

I consider this the greatest of modern discoveries next after printing and steam, and according to my opinion it ought to be as free as the air we we breathe, and as far as I have the power, I will do my utmost to render it like printing and steam of every day use: the great Fulton, like all great men never dreamt of protecting his discovery of the practical every day use of steam by a patent; no, he considered it of too much importance to the interests of mankind generally to be monopolised by an individual; and such was the conduct and opinion of Sir Humphrey Davy upon this very article I am now writing about, viz. galvanising Iron, &c. he it was who really made the first discovery of the preserving influence of zinc when put in contact with Iron, Steel, &c. he not merely made the discovery but he made the application also, and died declaring his conviction of the great practical utility of this his discovery, and regretted not being able to devote more time to it: He acted like Fulton, and never dreamt of a patent: the thing is of too much importance to the public good, to be teased, vexed, perplexed, or held back from their use, by secondary individuals, more especially, whilst the great original and true discoverer has bequeathed his discovery to the public for the benefit of all. Acting upon the suggestions and ideas of Sir Humphrey Davy: Dr. Revere who is at present living in this City; made a number of experiments as far back as the year 1828, and on the 17th March 1829, he made a communication upon this subject to the Lyceum of Natural History at New-York: he likewise sheathed a boat with Iron thus prepared, and invited the Society to examine his specimens at the Navy Yard at Brooklyn; he like his great predecessors never dreamt of a patent right, or if he has done so lately, I presume it must be the effect of example acting upon him; for Dr. Revere's communication in full. See American Journal of Sciences &c. by Pro-

fessor Silliman of Yale College: for the 1st July 1829, and page 180.

I consider this important and very useful discovery is in the public domain; I wish to call the public attention towards it; and I hope some public spirited and energetic individual who has the requisite Funds, will try the thing as regards this same patent right: I really consider the patent could no more be sustained, than could a patent right for some new application of steam; a scientifical principal cannot be patented; I wish to state to the public the question as it is; and hope some individual will succeed, who at the same time that he gains the right and advantage for himself, will likewise serve the public interest, in gaining the right for all.

I am proud to be able to say that I print my Book under the moral support, and Auspices of two hundred and fifty of the most influential and practical men of this great City; and whose signatures I have obtained on my canvassing Book; which I think proves clearly, that the public mind wanted to be enlightened, wanted information upon this important subject; I have endeavoured to serve the public to the utmost of my poor ability; and I trust the public will encourage and patronise me by buying my Book; *if I am successful in this my undertaking I intend at some future period to publish my views and experience upon another subject, equally interesting, but of an entirely different nature.*

New-York, April 1842.

EXPLANATION OF THE ENGRAVING.

Letter A.—Pincers for laying hold of any Article to be galvanised, they are turned at the end to prevent the Articles from slipping through; when you dip them in the Zinc Bath: length 22 inches.

B.—Shorter pincers, and used for the same purpose, length 19 inches.

C.—Straight common Pincers, and more convenient for use in some cases, length 15 inches.

D.—Used for galvanising Wire-work, and made in this form out of Rod Iron.

E.—Used for galvanising Wire, either coarse or fine, which is simply put on the end, and turned round and round in the Zinc Bath.

ADVERTISEMENT.

As a Book however well and clearly written; is after all nothing but Theory: I have seriously contemplated to give practical, manual Lessons to those who took sufficient interest in this very valuable, useful and universally applicable discovery: to explain, show and demonstrate with my own hand everything that does not sufficiently carry its own explanation: and to the apparently just remark: Why if you understand the business so well: why do you not do it yourself? &c. My answer is simple; my health is far from robust, and I will not undertake anything but what I can do justice to, and consequently I am obliged to do the best I can, and not as I would otherwise do: When I have made my arrangements, I will advertise time and place.

New York, May, 1842.

INTRODUCTION.

In this my introduction I will endeavour to clear away all doubt that yet remains on the minds of ten thousands of individuals in this Country, as regards the truth, utility, and goodness of the galvanised or Zinced Iron.

In the course of my successful Canvassing to obtain Subscriptions for my Book; I have had the question often asked me: Thus: What is this; perhaps it is all a Humbug, &c., and many have declared themselves opposed to its introduction, some from one motive, and some from another.

I will commence with my own positive knowledge and experience: I declare then upon Honor that I have a foot Bath, which I have had in use for more than four years; for three years, it never was a moment without Water in it, and under it; and for seven weeks out of the time it was constantly exposed at Sea, to the salt water, it has in fact been tried severely; and I again declare it is now as good as it was the first day I took it into use: my Wash-hand Stand, Wash Jug, and a large shovel I have had also in use for nearly four years; and they do not exhibit the least signs of Rust or Decay.

As the goodness and durability of the galvanised Iron, has been proved for the longest Period in France; I shall necessarily draw most of my proofs out of the Budget, where they are to be found the most numerous, the longest tried, and the most highly authenticated;

Having left Paris so recently as last August; I will state what I know: after a most severe and searching inquiry, by a scientifical Committee appointed by the French Government; of the most capable persons to be found in France to judge of the Galvanised Iron; this Committee, rendered its report to the Government in the month of May 1841. The Committee, was unanimous in recommending the use of the Galvanized Sheets of Iron and other Articles for the use of the French Navy: The Government has adopted, and acted upon the recommendation of its Committee: The last question resolved by the Committee was how far every article aboard a Man of War, in Copper or Brass, can be replaced by similar objects in Galvanised Iron: The Committee rendered their unanimous Report, which was entirely in favor of the Galvanised Iron, last July: for which see the official report, published in the "Annales maritimes de Brest:"

As long ago as the 29th of August 1839, Monsieur LeBaron Seguier, and who is also a member of the Academy of Sciences at Paris: writes as follows:

I have sir; to announce to you a piece of news; and which I believe will give you much pleasure to hear: I have just drawn my Boat out of the water; and after having stripped off several of the Galvanised Sheets of Iron, with which I had covered the joints of the longest Planks, I have had the satisfaction to find the galvanised sheets of Iron, as also the Nails employed to fix them; are in a perfect state of Preservation: It is nearly a year now, sir, since I accepted your proposition to make the trial of the Galvanised Iron under Water. I am happy to be able to attest, that after this space of time, no trace of deterioration can be perceived, &c.

Signed Baron Seguier.

Not to multiply too much of proofs, I will give the following as interesting to Shipping: at the same time remarking that I have many others in reserve, if it would serve any useful purpose to publish them:

To day 28th September 1840, the undersigned having learned that the Schooner LaNorma; had just arrived from the Iceland Fisheries, have immediately gone on board to examine if during the 5½ months which this Vessel has been engaged in Fishing, the galvanised Iron which we have taken an account of in our Proces—verbal of the 6th April, had experienced any deterioration from the rust, we have the great satisfaction to say that nothing whatever in her iron fastings; no more than in the Chains, and other iron work aboard, had experienced the least injury from rust.

That which has appeared to us as much more astonishing, as just to this day, we have no knowledge that anything has ever been found that was able to preserve the Iron from becoming

rusted in Iceland: seeing the fish-hooks they make use of which are doubly tinned, and in the best manner; yet, even they become generally rusted during one voyage: another observation that we have been induced to make in favor of the galvanised Iron; is that the caboose chimney of the Norma, except that it is blackened in different parts by the smoke, is otherwise in a perfect state of preservation, and it is likewise perfectly well known to us, that all the fishing vessels which depart from Dunkirk, with sheet iron chimnies, bring them back again in such a manner eaten away with the rust, that it is totally impossible to make any further use of them: This letter is actually signed by twelve experienced naval officers and captains, who have been in the habit of making long sea voyages.

The discovery of Electricity by contact, which Volta has demonstrated, was amongst the number of theoretical discoveries; but science by making use of the discovery, had already found out means of drawing numerous advantages from it; natural Philosophy in the first instance, and Chemistry afterwards; from it, have deduced new Theories, and explanations of various Phenomena, which were previously imperfectly understood.

All the great men who have honored science by their learning; such for example as Carlisle and Nicholson; who were the first who discovered the Phenomena electro-chemical; Sir Humphrey Davy, who has given their name to these Phenomena: Berzelius, who likewise has demonstrated the consequences to be deduced from it; Ampere who has created the Theory of it; all, have made it the object of scientifical researches, and which have considerably enlarged the Domain of Philosophy.

In the mean time, there yet was required, some practical application of it, of immediate and general Utility; Electricity by contact, was up to this time, one of those Treasures, for which it was necessary to find an application suitable and valuable to the various wants of commerce; and what use could it be applied to, of more universal interest, than the preservation of Iron and cast Iron, and Steel from Rust.

This universality, presents itself immediately to the mind: where is there any branch of Trade which has no need of Iron? Where is there an instrument for the use of man, into which Iron does not enter as an indispensible Element? from the spade and plough, to the most highly finished Clock-work; from the Cottage to the most sumptuous Palace, all, all, show the use of Iron, all denote its presence; and certainly, it is no more than truth to say it, that to this universal use of Iron ought to be attributed the name, which is given to the present age. Every where we turn our attention, Iron is sure to meet our view: Stoves, Chimnies, Carriages, Doors, Windows, Balconies, Window-blinds, Locks, Nails, Hinges, Iron Hoops for barrels, Ships, Tools, Houses, all just to military Arms, just to busks for Ladies corsets, the needles they make use of, Pens, all are in Iron.

That we by the imagination, cut off the use of iron from all the purposes to which it is at present applied, and nothing in the World, would remain standing. This destruction time alone operates, and man has more to do to repare his losses, than to encrease his riches.

The use of iron has but one limit, viz: its destructibility; it is this which has caused us to think the ancients were ignorant of the use of it. In the midst of ruins, time had concealed it from our researches. It was necessary that some few specimens which being buried in the depths of the Earth, had escaped a complete destruction; were discovered, and thus revealed to us its great antiquity.

To preserve iron from the destructive action of the elements, to prolong its durability, for it is the rust alone which destroys it, is not this to bring to the modern world, an immense Treasure, is it not to save them the expense and trouble of constantly renewing; to permit them an economy, an accumulation of strength and Capital, which cannot be calculated?

And this is not yet all: There are new uses for Iron immediately the rust no longer devours it. Roofing of every kind, for which zinc encreases the dangers of a Fire, iron steamboats, rendered universal, raised Terrasses crushed by the weight of Lead or of Bitumen, Hydraulic Works, Lead for Water pipes, which are only used for want of something better, Bathing Tubs, where its use is very expensive and consequently scarce, &c. &c. These are some of the new uses for Iron rendered rust proof.

Professor Dumas of Paris, expresses himself thus in analysing a letter written by an Ordinance officer of destinction: The land and marine service in France had lately a stock of Cannon Balls equal to 7,731,000 projectiles, this stock of Cannon Balls was valued at more than 26,000,000 of Francs; This ordinance officer calculated that after being exposed for 20 years in the

open air, a pile of balls is nearly good for nothing; now, if we bear in mind that the valne of a cannon ball sold as old iron, is but one third of the original cost, we shall easily see the value of endeavouring to preserve cannon balls exposed in the open air, merits every attention on the part of Chemists, and natural Philosophers. In admitting that the French Government might galvanise all their stock of balls (which they now do) and which would cost but little to do it, and would no more be liable to rust, it results from the calculations of this Ordnance Officer, an economy of 17,333,334 francs for 20 years, for this part only of the war department.

I think it important in this place just to notice a peculiarity and likewise the very great danger in covering any building with Zinc ; as it cannot be too universally known, the immense risk that persons run who through ignorance of the properties of zinc, have their Dwellings and Manufactories covered with it: I will copy part of a letter that I have in my possession, at the same time just noticing, that I have a dozen, if one is not sufficient.

A fire took place at Amiens in France in November 1840, in a large Linen Manufactory: the letter runs thus : by the carelessness of a workman a gas light set fire to some flax that they were drying in a warm room, the flames having broken the windows, communicated immediately to the roofing ; which was covered with zinc, this zinc immediately caught fire and burnt with so much rapidity, that neither the woodframe, nor even the thin planks of very dry deal wood were but slightly damaged by the fire, in every part that the burning manifested itself; although there was not a vestige of the zinc remaining, which in a few minutes, had been entirely consumed, without having had the time to set fire to the wood.

The galvanic paint powder, although more limited in its application, nevertheless, is capable of being rendered very useful ; as for example, in sending goods by sea, take what precautions you will it is impossible to preserve from rusting all articles in the hard-ware line, &c. The rust is a cause of much loss to the owners, and the price at which they are able to sell their goods, ought necessarily to be enhanced, in future; they may use the galvanic powder by covering the articles with this powder, or to envelope them with a coarse paper that has been prepared with this powder, or otherwise to rub the powder over the articles, will be sufficient to guaranty them from the effects of the Humidity.

We see then the great extent to which the application of galvanising may be employed ; besides roofing boats, bathing tubs, stove pipes, hydraulic pipes, gas pipes, in which last article the advantages of galvanising are lightness, economy, and durability : are often expended immense sums of money. The paint also presents no less advantages; taken alone it would be sufficient to sell it at the price of ordinary paint, to realise a very great profit, and who would refuse to give it a preference ; its superiority being so well established.

Experience has demonstrated that the iron is preserved from the rusting action of the air and of dampness ; not only on the parts which are covered by the zinc, but even in the parts which remain uncovered whilst these parts are not far removed from the zinc ; for example, in the part which is cut off the sheets of iron, which have been zinced, provided, that the thickness of these sheets does not exceed $\frac{1}{3}$ or $\frac{1}{4}$ of an inch, it is sufficient to note such a property to be able to appreciate all the value of it.

We know to-day, that in putting in contact, one with another, under suitable conditions, two different metals, the one most liable to rust, protects the other from the action of the rusting properties of the air, humidity and saline dissolution, &c.

It is to Sir Humphrey Davy, that we owe the discovery of this principle, so fruitful in useful consequences, this learned man, also pointed out and noticed the employ of zinc to preserve iron and steel from rusting, he even demonstrated the efficacy of these means, in showing, that instruments, the most highly polished, remained perfectly free from the rust, whilst they kept them shut up in sheaths and cases lined with sheets of zinc.

In tinning iron, the iron is rendered more liable to rust by the contact of the Tin, than whilst it is entirely bare, in such a manner, that when the Tinning is not performed with greatest care, the parts which are bare scale off and corrode in a very little time ; in the galvanised or zinced iron to the contrary, the iron is protected by the zinc, not only every where that this metal covers it, but even in the parts which by consequence of the imperfection of the operation, have remained bare of the zinc ; it is this very valuable property which characterises it.

They can galvanise or zinc every article in

iron, &c., no matter what it is, after they have given them any form they like.

The following remarks are true as regards Paris, France.

The galvanised sheets of iron are not dearer, at the same weight, than the sheets not galvanised; they are near about the same price as zinc in sheets, but besides, that they are much more tenacious and more flexible they have besides all these advantages, the one of not melting, and not becoming inflamed in the unfortunate event of a fire as the zinc does.

The galvanic paint powder can be sold in trade at a very low price, because it is made from the impure residue of the melted zinc.

Now what is true as regards France, will likewise be true as regards this country, after a little practice for I know of no valuable reason to the contrary: and that it may very soon be realised is my most sincere wish, I wish for nothing more sincerely than to see the welfare and prosperity of this country promoted especially when it can be done so easily, by an useful and mechanical, and philosophical discovery like this.

New-York, April 1842.

THE ART OF PRESERVING

IRON, CAST IRON, AND STEEL,

FROM THE

ACTION OF RUST BY GALVANISATION.

It is a question so important, the preservation of Iron from rust, that from a time immemorial the learned men of different Countries, have tried to find out the means the most efficacious: they have tried different substances to cover the surface of the metals; such as oily and greasy substances, and likewise divers varnishes; lately a French Chemist Mr. Dumas pointed out to the Academy of Sciences at Paris, a varnish made of India Rubber, and Mr. Payen the employment of alkaline solutions.

These diverse varnishes have the inconvenience of not adhering sufficiently to the metals, and to wipe, and to scale or chip off more or less easily, in this case, the parts of the Iron or Steel left bare of the varnish, rust rapidly.

In consequence of the great discovery made by Galvani and Volta; of the electricity, developed by the contact of two metals of a dissimilar nature; in perceiving, that one of the metals which composed the pile of Volta, was always preserved from the rust: the preserved metal, is always that of the two, which has the least tendancy for rusting; consequently in the ordinary Tinning of Iron converted into Tin; it is the Tin, which is preserved from the rust, to the detriment of the Iron: thus: in this case, the Iron is much sooner pierced by the rust, than if it had never been tinned; in the ordinary tinning of Iron, the iron is always electrified *positively*, whilst by the new discovery it is electrified *negatively*.

The first learned man whose attention was drawn to this phenomenon, was the late celebrated Sir Humphrey Davy, who proposed the application of the Galvanisation, to preserve Copper from the Corrosion of the Sea-water.

They tried Sir H. Davy's plan, but in a very imperfect manner, for the coppering of the Men of War, &c. the manner employed, consisted in adjusting pieces of zinc, of Iron, of cast Iron, or of Nails, made of these metals, on the Copper, that they wished to preserve from the destructive action of the Sea-water: Sir H. Davy tried likewise, a few years ago, to preserve Tin from rusting, by means of Galvanisation, but in pursuing always the same plan, whose principal inconvenience, consists in a difficult and restrained application, and only well preserving from the rust, those parts, in immediate contact with the zinc.

The means that I am going to describe is also based on the property of the contact of two metals of a different nature; but the application of the principal, is very different, and the manner of applying it, is suitable to every article.

This new discovery, is applied in several manners, having each of them, their particular manner to preserve Iron, cast Iron and Steel from the action of the Rust.

See here: the three principal manners of applying this new discovery; first by way of zincing; secondly by painting, thirdly in covering the articles, that they wish to preserve from the Rust, with the galvanic powder; likewise a

fourth manner of applying the same principal, to preserve from Rusting Iron articles that have been polished, on file without changing their metallic appearance; this means consists, in rubbing the articles with a paste:

I will now describe, in the clearest manner possible the Art and Secret of galvanising the Iron, in following the same order as that I have just named, for the divers ways of galvanising:

GALVANIC ZINCING.

This galvanic Zincing consists first in covering completely the surface of the Iron, with a coat of Zinc, and secondly in covering the Zinc with a coat of pure Tin, or mixed with Lead, the second tinning is optional, the object of it is, to preserve the Zinc in certain cases.

Decapage or cleansing the Iron of its outer Coat, and preparing it before it is covered with the Zinc.

To apply the galvanic Zincing, they commence by well cleansing the Iron that they wish to galvanise; all the ways for cleansing the Iron are good, but the manner that has the best answered for me, is the immersion of the Iron in acidulated water, the water is diluted with the sulphuric Acid reduced to 10 degrees of strength; easily ascertained with the instrument, for testing acids. It is well also to try to employ the acidulated water at different temperatures:

They warm the acidulated water in Vasses of Lead, or you may employ it cold in wooden Tubs, and they there put the Iron; *if it is in Sheets they place them on a kind of frame;* which permits the acidulated water to penetrate in every part; they do not leave the Iron in the acid, but just a sufficient time, to cleanse it from the Rust or outer coat, in taking it a piece at a time, to cleanse it over again with sand or pounded stone, in rubbing it with a piece of Cork; they wash the Iron making use of a brush for that purpose, as soon as the Iron appears cleansed from the Rust or other impurities; after that it appears clean, it is then put in water; small articles such as Nails, have no need to undergo this operation; they leave them a little longer in the acid, and afterwards wash them:

Iron prepared in this manner, can remain, if it is necessary for a month in the water without sustaining any damage; it will not be spoiled; it is not the same after the following operation: this operation consists in moistening the Iron piece by piece, if the articles are not two small, in a solution of ammonical salt, or prehaps, that which is preferable in water acidulated with muriatic acid.

They put about half acid and half water, and they dry immediately, the articles moistened or dipped in this acidulated water, and they zinc them in the promptest manner possible, for two hours after the immersion in the muriatic acid, the Iron would be rusted, in such a manner, as not to be possible afterwards to be zinced; (they will be able to dry the articles by placing them in an Oven, of which I will speak in another part.

Zincing of Iron in Sheets and large pieces.

The first Tinning is performed with Zinc; they ought to melt the Zinc, in an Iron or cast Iron Cruset, but furnished in the inside with bricks, or an earthy coating such as Clay, to hinder the contact of the Iron with the melted zinc, for otherwise it would be a mixture of Iron and Zinc which would render the Zincing impossible; they have made use of Vessels in cast Iron of a rectangular shape, similar to those that they make use of for Tinning; they have placed in the inside bricks well cemented with Clay:

The covering with the zinc, is performed in the following manner: the zinc being melted, they skim it well, and then cover the surface with muriatic salt or ammoniacal salt (but the muriatic salt, is not much more than half the price of the other and answers quite as well, in powder, or with any other salt of the same nature, that done, they introduce, in the melted metal; the pieces of Iron prepared as I have described before; they balance them for a moment in the bath, *and they draw them out slowly, that they may not be loaded with Zinc, afterwards, and before the Zinc is become hard, they throw the Zinced pieces in pure water, and as quick as this immersion, they wash them with a sponge or a brush, and they dry them immediately in putting them into saw-dust or bran.*

This operation of the immersion, and washing immediately afterwards the Zinced articles, is of the greatest importance, as without this precaution, the articles would become blackish in places, in such a manner, that, it would be impossible to sell them in trade; on the contrary prepared as it is described above, they become as white as silver: they may obtain them whiter yet, in plunging them rapidly in water acidulated with

the sulphuric acid before having plunged them in the pure water.

The bath of melted zinc, *ought not to be very warm :* they ought to commence the zincing a little time after that it is entered in fusion; if the bath was too warm, it would burn and evaporate very soon the muriatic salt, which ought constantly to cover the bath, they can likewise diminish the consummation of the muriatic salt, when the size and nature of the pieces that they prepare, permits to reduce the surface of the bath; they can easily diminish the surface in there placing some bricks, which swim on the melted metal.

When they prepare Sheets of Iron of small dimensions, such as those of the size of Tin, they zinc several of them at the same time (six for instance) they place them on a grating, that they hold with two handles; the Sheets ought not to touch one another; they hinder their contact by Iron Wires turned back, and fixed on the grating by the two extremities, and placed between each sheet.

In order to lose, the least possible time, of combustible, and of muriatic salt, they ought to employ two workmen on each bath: they are placed opposite to one another, and furnished each with a handle or instrument proper to lay hold of the articles; for the large pieces they introduce them in the bath one and one, with a pair of pincers or tongs, of which the part that grasps the articles should be pointed in order to leave the least possible traces on the zincing; they ought to introduce the large pieces, *very slowly* in the bath; without this precaution there would be an explosion, and projection of the melted zinc, which is of course very dangerous; for the preparation of very large pieces, they will make use of a Crane furnished with hooks; the Crane in its circular movement will carry the pieces in the bath of metal, from the bath in the water, and from the water to the place where they can be cleansed from the spots caused by the muriatic salt.

Flattening the Sheets of Iron.

The sheets which become deformed by the effect of the too great heat of the zinc bath, or of which the surfaces are too uneven, they put them under the Flattener, but that they may not become more deformed in passing between the Cylinders, they are obliged to sprinkled them all over with Ashes, with Rosin or any other substance in powder, that can be employed to hinder the Cylinders from gliding or slipping on particular parts of the sheets.

*Preparation and Zincing of small articles such as Nails, Chains &c.**

They prepare these articles previous to being zinced, by the processes I have described for the large pieces, and for the iron in sheets; only in the place of rubbing and cleansing them with the pounded stone or sand, they stir them from time to time in the acid, to enable the acid to act on every part, and likewise, by the rubbing one against another, the Rust may become cleansed from the different places; it would be well when they work on a large scale, to cleanse the small articles in a barrel that they would make to turn on an axle-tree; or otherwise, without cleansing the small articles in the barrel, they can put them in the barrel after the cleansing, and at the first washing in the water.

The articles thus prepared pass to the muriatic acid, and dried in the oven of which I shall very soon have occasion to speak, they will proceed to the zincing in the following manner:

They put in a considerable quantity of the small articles in the mettled zinc, and covered with the muriatic salt, and after having left them there a moment, they draw them out slowly with an iron skimmer, and by small portions, for that they may of themselves discharge as much as possible the too great quantity of zinc, that they are apt to retain.

The articles after this operation are soldered one to another, and retain yet too much zinc, but to clear them of this excess, and to unsolder them, they put of them, a quantity in an oven, they cover them with Charcoal, and they keep them very hot for about a quarter of an hour, they stir them up from time to time, with an iron rod or poker, just to such a time that the articles may have sufficiently discharged the too great quantity of zinc; then they put them on the before part of the oven, with a kind of iron rake, *and they continue to stir them just until the zinc is become solidly attached;* afterwards they

* I mean here small Chains for the large ones are prepared by the same process that is followed for the large pieces, they shake them well as they can out of the bath, to hinder the different Links from becoming Soldered or sticking together.

spread them on the ground, or in water, and they wash them in the water, and afterwards in the water acidulated with the sulphuric acid; they must not be left too long a time in the acid, otherwise the zinc would be very soon dissolved; after the acid they wash them in the pure water* and they dry them in saw-dust or in bran, or they dry them on the oven, in a place that they have made expressly for drying before and after the zincing.

The pieces being dried, they move them in a bag or in a barrel turning on an axletree, in order that by their mutual friction they may polish one another.

The zincing of small articles, particularly Nails, ought to be done in a small vessel, in order not to run the risk of spoiling too great a quantity of zinc, for if they forget and leave too long a time the Iron articles in the hot zinc, it will become unfit to be any longer used for zincing.

The zinc that they use for zincing ought to be as pure as possible, you can easily discover the quality of it, in breaking a piece; it will be as much more pure, as the parts are more brilliant at the place where it is broken.

This trial ought to be made with zinc that has not been rolled or flattened: they employ zinc of an inferior quality, or the zinc that has been spoiled by the Iron, to make the galvanic powder of which I will speak in another place.

Galvanisation of Iron Wire.

They galvanize iron Wire, in making it pass horizontally in the melted zinc that is covered with muriatic Salt; they proceed in the following manner, the iron Wire being prepared, and cleansed from all impurities, having passed through the muriatic acid, they unrol it on a cylinder turning on its axletree, and they hook one of the ends of the Wire to another cylinder similar to the first, they then turn the empty cylinder, at the same time the wire in passing from one cylinder to the other, passes through the melted zinc, on which there is an obstacle which forces the Wire to pass through the zinc bath; after this operation they clean the Wire, in the same manner that I have described for the other articles; besides that they may pass it by the Wire-drawer, or rub it with emery paper.

* They can without injury to the articles suppress the washing with the acid and water.

The Double Zincing or Tinning.

The double zincing is not necessary, only on Iron in Sheets or large pieces of wrought or cast Iron, besides the necessity for the double zincing can but rarely be required; it will only be requisite in very rare cases, where the single zincing would be destroyed, by the contact of certain substances, or otherwise if it was required to make Vases that were wanted to contain acid substances.

Nothing can be more simple than the zincing or tinning of pieces that have been already zinced; they use for this object pure tin or it may be mixed with lead; they can put say two thirds of lead; they dissolve these two metals in a cast iron vessel, and they introduce therein the pieces that they wish to tin; in the meantime, it is necessary, to succeed, to follow with the greatest care, the process that I am going to describe in a few words: They pass over the pieces that they wish to tin, a sponge or a brush *moistened* in a solution of ammoniacal salt, or what is still better in the pure muriatic acid, and they plunge the pieces, thus wet or moistened, in the bath of tin, which must be covered with a considerable coat of suet or grease, (at the least two inches,) the bath ought to be very hot, nearly sufficient to burn up the grease; they ought to introduce the articles *in the tin, one by one, and very rapidly, but to take them out again immediately and slowly so as to give sufficient time for the tinning to take effect; mind it is not necessary to take out the articles too slowly,* for the zinc would otherwise melt off from the zinced articles, and would thus spoil the bath of tin; besides the articles deprived of the zinc would not be galvanised.

Immediately after the tinning, and whilst the articles are yet warm, they cleanse them with saw-dust or bran.

They can likewise apply the manner of tinning that I have just described upon zinc that has been rolled or flattened; by this means it will be much whiter, and less liable to Rust, but it will have its other imperfections; it is better to tin the zinc in the condition or form it is in after being melted, and to flatten or roll it afterwards; by this means it will be smoother, and will take less tin.

Galvanic Powder: the manner of making it.

The galvanic powder is simply zinc reduced in powder, they make use of the galvanic powder in several manners to preserve Iron from

Rusting: first as paint: secondly in powder; in placing under the powder the articles that they wish to be preserved from rusting: thirdly, in forming with this powder and other substances a kind of paste, to rub iron articles that they wish to preserve from the Rust; before entering in the details of these divers processes, I will first describe the manner of making the galvanic powder.

It was no small difficulty to overcome, that of reducing the zinc into powder, and at but a trifling expense; at the same time after repeated trials and experiments, I have been very successful, and have completely succeeded.

To make powder of zinc, they put the zinc intended for this purpose in a vessel they hinder from penetrating in this vessel any current of external air, which would be likely to increase the combustion of the zinc, and they augment the heat of the melted zinc, nearly until it becomes red hot, afterwards they skim the zinc, and then cover it with ammoniacal salt, and immediately afterwards, *they put into the melted metal, in taking care to stir it up continually, one tenth part of its weight of wrought iron filings, and not cast iron filings:* before putting it in the zinc, the iron filings ought to be *moistened* with muriatic acid, after the introduction of the iron filings, they cover the surface of the metal with fine charcoal powder, and they increase the heat of the melted metal, until it becomes a white red; they keep it at this heat for about quarter of an hour, in stirring it up from time to time with a poker, afterwards they draw out the mixture with a help of a rake; using it to raise up a brick that serves to let you see into the mixture and the melted metal is conveyed into a reservoir of Cast Iron, or reservoir formed of bricks that is lined with an iron coating to hinder the combustion of the zinc: that done they ought with the aid of an iron poker or bar which passes through the cast iron cover, and in which they have left a hole expressly to enable you to stir up the mixture, until such time that it becomes solid, this mixture, thus become solid, is the galvanic powder.

Galvanic Paint.

This paint, as likewise the galvanic Zincing, possesses the invaluable property of perfectly preserving Iron from the Rust.

The galvanic paint is composed of galvanic powder, well reduced in powder by means of the Painter's Muller, and diluted with liquids such as are generally used for preparing paint and varnishes; every kind of substance answers as much better as it is a good Conductor of the galvanic fluid; I have made very good paint, with the Oil proceeding from the distillation of coal Tar, such as is produced in the Gas Works. The coal Tar itself is not bad in mixing with it a third of Turpentine to facilitate its drying, but on account of the strong smell, it cannot be employed for all kinds of articles. They can also make use of a greasy varnish, but then there would be the inconvenience of its being too expensive, they might likewise make use of Linseed Oil as is done in preparing the common paints, although this Oil does not altogether favorise so much the galvanic effect of the z there would not be in fact, any impropriety, in putting in the paint, either Minium or White Lead, to give a body to the paint:

The galvanic powder is employed also in other forms than paints, as in powder to preserve from Rust, all iron articles that have been polished or filed, and also other articles, such as those employed by Watch-makers, the Hard-ware Trade, &c. it is only necessary, to preserve these kinds of articles from the Rust, to place them in the galvanic powder in the position they will be preserved from rust, even in the case of their being exposed to the water.

They can also form with the galvanic powder a kind of paste, to rub over polished or filed iron articles, that they would wish to presesve from the Rust, this paste is made with Wax, that should be melted and into which they put ten times as much galvanic powder, and about 1-50 part of Suet or Oil; I ought just to notice in this place, that this paste does not produce any wonderful effect:

They can likewise make with the galvanic powder a paper proper to envelope polished Iron or Steel articles, that they would wish to preserve from the Rust; they would also be able to make a galvanic paper of an inferior kind, for the purpose of wrapping up all Iron articles, to preserve them from the Rust; they can make this paper in putting zinc that is ground to an impalpable powder in the paste of the paper at the time it is being made, or in sprinkling the powder all over common paper that has been prepared with a gluey or sticky substance, such as Gum Arabic, or flower paste, but not size, as the size will cause the Iron to Rust:

The preservation of Iron by this process, is not owing solely to the galvanic fluid, of which the action ceases very soon in consequence of the oxydation of the zinc, which itself is electrified positively.

It is the Oxyde developed by the galvanic contact, which attaches itself with considerable strength to the zinc, and likewise to Iron which has become bare, which preserves it from the Rust, in the same manner as an indestructible varnish would do: they can make the coat of this oxyde more solid yet, in forming it artificially by the help of a chemical agent. That which has the best succeeded with me is a dissolution of ammonical salt, with which they wet the metal, after it has been cleansed with gritstone reduced in powder; by moistening and rubbing it with a rag, by the employ of the muriatic salt, it forms of itself on the metal a hard coat of muriate of zinc, perfectly indissolvable in the water, which covers and preserves the Iron from Rust, in the same manner as a superior varnish would.

END

Of the first Series of Instructions for galvanising Iron, Steel, &c., but experience having suggested many Additions and new discoveries, *see the 2d Series of Instructions*, and likewise a great deal of additional matter and information connected with them.

PRACTICAL INSTRUCTIONS

FOR THE

GALVANISATION OF IRON.

Decapage, or Cleansing the Outer Surface.

The decapage is done; in oblong wood troughs that are strongly made, and well hooped with Iron Hoops, and lined in the inside with Sheets of Lead; they may at the same time dispense with lining them with Lead, the troughs are made out of heart of Oak; but with wooden troughs, that are lined, you have the inconvenience of not being able to depend upon them, on account of the risk of their splitting, the oblong shape is best suited for the decapage of long sheets of Iron.

They ought before commencing to use the wooden oblong troughs, to paint them over with several coats of paint, or mineral tar;

The best possible Acid you can use for decaping the Iron, is without contradiction, the acidulated water that has served for purifying Lamp Oil.

This acid possesses the very valuable property of decaping the Iron, without injuring or corroding the metal; and moreover it can be purchased for nearly nothing, as it is after it has performed its office of purifying the Oil, and consequently no longer of the least value to them, that it becomes useful for decaping the Iron; in general persons would be glad to be rid of it, in that case it will cost the price of the Cartage, and no more; if they cannot procure a sufficient quantity of this Acid, it would be necessary to mix it with the ordinary acidulated water; it will communicate the same properties to the water, if it is employed but in small proportions.

In case of not being able to procure any acidulated water of this kind, they make use of muriatic or sulphuric acid mixed with water, the decapage is done equally well with either of these two acids, but the sulphuric acid is the most economical, although the first cost is more: the sulphuric acid, has the advantage over the muriatic acid, of lasting a longer time, without the necessity of being so often renewed, or which comes to the same thing, of serving to cleanse a greater quantity of Iron, for the same quantity of acid; moreover they can sell the residue of the decapage, which is the Sulphate of dissolved Iron.*

It is advantageous to heat the acidulated water; the heat augments the action of the acid on the Iron, and permits a less quantity of acid in the water; the strength of the acidulated water ought to vary from 10 to 15 degrees of the instrument for trying the strength of acids; it will require as much less strength, as the acid is more heated; they warm the acid; either in causing Steam to pass through small pipes; serpenting in the cleansing troughs, or by means of a lead vessel containing boiling water; that they put into the acid, this Lead Vessel is similar to what they use for warming the water, at the Bathing Rooms.

The sheets of Iron, ought to be placed on a kind of frame in the trough, as without that the acid would not be able to penetrate in every part, that they ought likwise to move them from time to time, to change the points of contact of the sheets of Iron.

* To make the most of this Sulphate of dissolved Iron, which is difficult to remove on account of its weight as a liquid, and likewise difficult to sell on account of its being dissolved; it will be well to crystallize it; for this purpose, they will put it in a Leaden Vessel, and place it on a Stove, they will add to it some Iron clippings or iron filings, to completely saturate all the acid, afterwards they will leave it to crystalize in the oblong Troughs.

The second Operation is the Washing in Lie-Water.

The washing in the lie-water will not be necessary, only in case of having made use of the acidulated water, which has served to purify Oil; this acidulated water will always retain a greasy or oily substance, which becomes attached to the articles, and hinders the zincing from taking effect. The lie-water is made with potash, or with pearl ashes, they make it have a strength of about 6 to 8 degrees of the Areometre, and they warm it in the same manner that I have described for heating the acids.

After having rinced the cleansed articles, they put them for a minute in the lie-water, and then scrub them with a brush to cleanse them from all the greasy particles.

The third operation, Second Decapage.

The second decapage is done with the muriatic Acid mixed with water, this second cleansing has for object, to take off whatever might yet remain of oxyde on the articles; this acidulated water ought to have about 10 to 12 degrees of the strength of the Areometre.

They can dispense with heating this acid; they leave the articles during several minutes in the acid, and they then draw them out, to examine if there yet remains any oxyde attached to them, if there is any, they take it off in rubbing the places with a piece of gritstone, which they moisten with pure muriatic acid; the gritstone or porous stone is the kind that I have found to answer the best for this purpose: if independently of the spots, the articles are not perfectly white, they brush them with a brush and sand or gritstone reduced to powder diluted with the acidulated water, that has been acidulated with the muriatic acid: afterwards they rince the articles in water, to cleanse off the sand; from there, they carry them to the trough, which contains water that has been slightly acidulated with muriatic acid.

This water ought to have about six degrees of strength of the Areometre, it will be necessary to dissolve in it a little zinc, and likewise to put in it a little muriatic salt. This composition gives to the iron the property of attracting less zinc.

The fourth operation is the drying.

Immediately after the last cleansing, they carry the articles to the drying oven to be dried, it is not necessary that they remain in the oven a moment after they are dry, for, in that case, they would become rusted, and the zincing would be badly done; it would be better even to zinc them whilst they were yet moist; the drying is done in a brick oven, heated with coke or charcoal.

Fifth Operation, the Galvanic Zincing.

Immediately after the drying, *and without any time of stopping*, it is necessary to zinc the articles whilst they are warm.

This is the way to have superior and beautiful articles, and consequently to have more business to do; for the articles that are warm can be zinced more promptly, and the more they zinc the articles quick, the less will the articles become loaded with zinc.

It is necessary that the bath of melted zinc, in which they zinc the articles, should be completely covered with the muriatic salt; except for the galvanisation of nails! but it is absolutely necessary for all kinds of wire-work and iron-wire; they use the muriatic salt reduced in powder, that they keep throwing from time to time on the bath, with a spoon.

It is of an immense importance for the economy, and for the quality of the productions, to work at a suitable temperature; but to know exactly the temperature at which they ought to work, it would require a pyrometer, or a thermometer, and unfortunately there is no such an instrument to be had that would tell you exactly the temperature of the melted zinc; by and by such an instrument will be discovered; as soon as it is, I will make it known, and likewise the manner of using it: in the meantime, I will say that the temperature which appears the most suitable, is that at which the kind of scales, which form on the articles, when the bath is too cold, have disappeared; less heat, gives a heavy covering of zinc, and covered with scales; and more heat gives a thick and fragile zincing, and likewise deforms the articles, particularly if they are sheets of iron or utensils of a slight make, and moreover consumes much more of the muriatic salt.

It is necessary always to introduce the articles into the bath, in the quickest manner possible, and to draw them out again directly, but slowly, that the articles may not draw with them too much zinc.

All these observations are of great importance,

particularly for sheets of iron that they intend to be manufactured after the galvanization. The articles being drawn out of the bath, they throw them in the water to facilitate the cleansing them of the muriatic salt, that the zincing retains; but it is necessary to pay attention not to throw them in the water too soon, for in that case, the zincing would be rough and covered with small globules; it is necessary before throwing the articles in the water, that the zincing may have had time to become settled and solid.

I will describe in this place, the manner to galvanize nails, and iron-wire, for the reason that these articles are not galvanized in the same manner as the other articles; see, as follows: the manner to galvanize nails and all articles of a similar nature.

For these articles they do not put the muriatic salt on the bath, they take the nails whilst they are well cleansed and dried, and they put them in an iron-wire basket, or in a basket made of a sheet of iron pierced with a great number of holes; they hold the basket by a long wooden handle, and they introduce it into the bath, after having sprinkled the articles all over with muriatic salt: whilst the articles are in the bath, they keep stirring them with an iron poker in the form of a small spade; and at the moment of drawing them out, they sprinkle them afresh with the muriatic salt, afterwards they draw them out, and they shake them well to take off the excess of zinc, and they throw them, at the same time keep shaking them, upon an inclined plane of sheet-iron, which conducts them into a tub of water.

To separate the articles that are soldered one to another, and which ought to be distinct and as clear of the zinc as possible, they put the whole into an iron sieve, of which the holes are large enough to let pass the single articles, and retain those which are soldered to one another.

The iron-wire is galvanized in the following manner: before decaping or cleansing it by means of the acidulated water, they divide it into small bundles, in each bundle they tie the two extremities of the wire together, and they put one or two ties loosely, to hinder the wire from becoming entangled; they are then cleansed and dried. and they introduce the articles one by one into the bath, in holding them on an iron-rod (See Engraving, letter D,) made at one end into a semi-circular shape, they keep turning it constantly in putting it into the bath, and likewise when they draw it out, in order that the wire may not become soldered together, and when they are zinced, they throw them in the water.

The zincing ought to be done in crusets *in wroüght, and not in cast iron. Length of the cruset in english measure,* 6 *feet,* 3 *inches. Depth of the cruset,* 3 *feet,* 9 *inches. Width of the cruset,* 2 *feet at the widest part, or the middle,* as the shape is an oval. The oval form is that which suits the best to galvanize articles of every form and shape, and with the least zinc possible in fusion, and besides the crusets of this shape resist very well to the pressure of the melted metal.

They fix the cruset on the grating of a brick oven, which leaves at the sides, between it, and the cruset, a space of four or five inches destined to receive the combustible that they put in at the top. This fuel ought to be coke or charcoal, but the coke is the most economical; they make horizontally several rows of holes on the cruset; these holes ought to be of the size of two brick-ends, they close up with brick-ends these holes, and likewise the doors for taking out the ashes ought always to be shut during the time of working; the workmen ought not to open, only, the holes of the upper row, when they want to regulate the heat of their bath; the other holes, aud likewise the doors for taking out the ashes, ought not to be opened but once a day; to clear out the ashes.

They ought to close them afterwards, and cement them with the greatest care with moist clay and brick-ends; without taking these precautions, they would burn the cruset in a little time, and besides it would cause to rise to the surface of the bath, the residue of the zinc which had sunk to the bottom, and the zincing performed under these circumstances would be the worst possible, and likewise the articles would take a greater quantity of zinc.

The zinc which they make use of for the zincing, ought to be as pure as possible; a very small proportion of wrought or cast iron in it, will render it unfit for the galvanic zincing; they can see if it is pure or not, by breaking a piece of it, that has not been flattened or rolled; the facets of pure zinc, whether they are great or small, *have an even and brilliant surface;* if the zinc is again broken, the contrary is the case, with zinc which contains iron, it has always the facets rough, and as much more uneven and rough, as the zinc contains more iron.

Cleansing of the Galvanised Artciles.

Likewise, as I have before said, the articles that come out of the melted zinc stained by the muriatic salt burnt, composed principally of the chlorure of iron and zinc; to cleanse them of this salt, they spread on the articles some moistened sand, and they scrub them with brushes or pieces of cork; the cleansing is done more easily if in the place of pure water to dilute the sand, they make use of water slightly acidulated with sulphuric acid. After this cleansing they wash them several times over and *immediately;* and after the washing, they dry the articles by passing them through saw-dust or bran; before making use of the saw-dust or bran, it is necessary to sift them, to cleanse the saw-dust, &c., from the earthy impurities, which would otherwise attach themselves to the articles, and soil them.

END

of the Second Series of Instructions: see now, the miscellaneous matter, which is, some part of it, of a great importance.

MISCELLANEOUS MATTER.

Galvanic Paint.

This new preserving process, is based on the same principal:

It is always by the galvanic effect of the zinc, when it comes in contact with the Iron, that this last metal is preserved from the Rust; but the manner of applying the zinc on the Iron is very different from the various processes I have described already: see in a few words, the manner of making the galvanic paint.

They take the zinc reduced to a very fine powder, by the means that I am going to describe or any other; and they dilute it with the oils, and other substances, usually employed for paints or varnishes:

They may likewise put in the galvanic paint, all the various substances they employ to form the divers colours:

The means that I use to pulverise the zinc, is very simple; it consists in forming an amalgamation of mercury, and of zinc, and when the mixture has become cold; they pound it in a mortar: they can employ the same means to reduce in powder Lead, Tin, Copper and other metals: This mixture being reduced in powder, they heat it to evaporate the mercury: they ought during this operation to stir up the mixture, and to take care, not to heat it too much, for without these precautions it would become melted; they would be able to operate the evaporation of the mercury in an Iron cylinder furnished in the inside with points, or provided with an agitator; they are to place this cylinder on the fire, and they will make it turn on its axletree, if they wish to save the mercury, that which is very important, when they make the paint on a large scale; they will make the cylinder communicate by one of its axeltrees with a reservoir of water, into which the mercury will pass, and become condensed: they would be able to dispense themselves of the trouble of evaporating the mercury, but in that case, the paint would cost more, without being any better:

One thing that I consider very important, is, to hinder the contact of the external air with the mixture during the evaporation of the mercury; in taking this precaution, the zinc powder will have better retained its metallic colour, for it will not be tarnished with the oxygen.

The galvanic paint can be employed on Copper, and other metals, they may likewise use the zinc powder alone, to contain polished metals that they wish to preserve.

Galvanic Paint.

This paint is made by mixing zinc, reduced into a very fine powder, with varnish or common paint: now, it is a very important consideration to employ those means, that are the most simple and economical to reduce the zinc into powder: After a great number of experiments and trials, I have found a method simple and economical to reduce the zinc into powder: this method consists in forming a mixture of Iron and zinc: they put about ten parts of zinc for one of Iron; this mixture after that it has become cold is extremely friable, and it will fall in powder of itself: they obtain the zinc powder finer still, in continually stirring the mixture during the time it takes to become cold, or in pounding it in a mortar that has been heated.

The zinc powder mixed with wax or other substances can be employed to rub over arms, or other polished Iron articles, in order to preserve them from the rust, without materially diminishing their metalic brilliancy: I will mention here, in terminating, a fact foreign to the subject, but which is not perhaps without interest to science.

I have observed that the mixture of Iron and zinc enjoys a curious property, which is contrary to the nearly general law of the constitution of subdued bodies: at a decrease of temperature, this mixture on the contrary, becomes considerably dilated in becoming cold, and breaks the vessel in which they have left it to become cold.

The art or secret to make the paint red, red brown, green, and black: is as follows: take of cast Iron a quantity, and sprinkle it all over with water diluted with an equal quantity of muriatic acid: the sprinkling is to be continued from time to time, taking care to stir the Iron well up; it will require about four pints of this mixture for 100 lbs. of Iron, and to be sprinkled once a day for three or four days; afterwards leave it for 5 or 6 days more, and it will become heated by being left, at the expiration of this time, it is to be put in the cruset, and when all the smoke has evaporated it is finished; it does not require to remain long in the cruset or other vessel to heat it; to make it red, it will be soon done; to make it a brown red, it will require a little longer time to be heated; and to make it black it requires a longer time still. "*To make the green paint:*" take an equal quantity of zinc, and of Iron Rust, or of Cast Iron rusted, but mind particularly the Iron Rust, or the Cast Iron rusted is not to be sprinkled with the acid and water; only immediately before it is put into the cruset along with the zinc, then when it is cooked sufficiently and become cool, it is put into the mill and ground into a fine powder; of course it is intended that before putting it into the mill, it will be necessary to break the lumps in a mortar.

I have said in another part that to reduce the zinc into powder, it was necessary to mix with it, one tenth part of its weight of iron filings, but since that time, experience has taught me that the presence of Iron, answered not fully in giving a preserving influence to the paint, &c. This result has induced me to increase much the proportion of the Iron in the mixture: I put now at the least as much Iron as Zinc, I have even made very good paint in using wrought or cast Iron alone, partly rusted, and reduced in powder by the following method; which consist: to heat strongly in a Vessel or an Oven, the wrought or cast Iron, that it is partly rusted, and in continually stirring it up during the operation of heating, to facilitate the mixture of the metals, one with another, and to soften, and to rust the Iron: if they wish to employ the Iron alone, it is well to water it, with water that has been acidulated with the muriatic acid, before putting it on the fire:

Experience has learnt me that the polishing (by means of a brush, and the burnishing, are the best and perhaps the only way of polishing) that is applicable to a zincing, for the reason that this method following regularly the surface of the zincing, without completely rubbing it off in places, as they would be liable to do with any other method, besides all that, this machine will cause the pieces of cork to pass four times more over the sheets of Iron.

The method of heating the Vessels or Crusets, that appears to me the most suitable, consists to place around the Crusets, and in contact with them, coke or charcoal.

The cylinder of the roller to prepare the galvanised sheets of Iron ought to be rough.

They can employ Lime-water or any other alkaline dissolutions to preserve iron articles, that it is not convenient to galvanise immediately after the cleansing of the outer coat.

I will just notice in this place that they can make a galvanic covering not only with Zinc, but likewise in mixing with this metal, different other metals, such as Tin, Lead, Bismuth, Mercury, Copper, &c.

The screws, and other parts of Iron articles that they wish not to be covered with the galvanic zincing, they cover these parts with a coat of clay, or if there are holes, they stop them up with wood, previous to their being put in the acid; they can avoid on those parts of Machines, where it is not necessary to be prepared, the action of the acid, in covering them with Tallow or Wax; if they wish to give to the galvanised articles a particular grey colour, which is different to that of zinc; they galvanise them in zinc, that is heated until it becomes red hot; or after having covered them with zinc not altogether red hot, they will heat them red hot in a reflecting stove; they can produce an oxyde very solid and durable by the galvanic covering, in moistening the pieces several times over with a saturated dissolution of ammoniacal salt; the zinc powder which forms the base of the paint, can be made on a large scale in a reflecting stove, and they will also prepare in the same stove, the nails, and other small articles.

To prepare very large sheets of Iron, without having very large crusets, they can make use of vessels of a half circular shape, they introduce the sheet by one side, and draw it out by the other side.

The object of these few additional remarks, is the application of the galvanic process to military arms, and other articles in polished or filed Iron; for these articles, the zincing, such as I have described it previously, is not sufficient; the zincing ought to be done with the purest zinc; and in a cruset of a rough kind of earthen ware; the crusets intended for articles of a large dimension, ought to be placed in other wrought or cast iron crusets, in order that they may be supported by these last; they fill up with fine sand the space comprised between the earthen ware cruset and the one in iron; they cover the melted zinc with muriatic salt, in the manner I have before described; but to prevent the Salt from staining the articles in adhering to them, when they draw them out of the bath; they mix with the muriatic salt, some earthy substances in powder or in pieces; when the pieces are well covered by the zincing, they polish them; they commence in the first place, by taking off with great care, all the unevenness or roughness produced by the zincing, by means of files and scratching-knives, afterwards, they make use of pounded stone, of grit, or of sand paper; after that they finish the polish as if it was on any other metal; it is important not to make use of hard substances to prepare the zinced articles and to give the polish; they ought to use Cork, Leather, a piece of Rag or similar things; as without taking this precaution, they would be apt to take off the zincing in certain places.

To cover Iron with a surface of Copper.

They form a mixture of Copper and Zinc, in the proportion of one part of Copper for two of Zinc or thereabouts: This mixture ought to be white and very fragile; the mixture being cold; they pulverise it in a Mortar in mixing Borax with it; the pieces of Iron, cast Iron, or Steel, that they wish to cover with Copper, being well cleansed of the Rust, or all other outer coat, they cover them all over with a greasy or viscous substance, and they sprinkle them with this mixture and Borax, afterwards they place them in charcoal powder, and they then heat them a sufficient time to evaporate the excess of zinc, they can easily perceive, that the operation is finished, by the little zinc vapour which escapes at the end of the operation: when they think proper to draw out the pieces of iron, they take them out with the charcoal which covers them, and they plunge them in water, with the charcoal still adhering to them, and whilst the pieces are yet red hot.

After this operation, the Iron is perfectly covered with a coating or surface of Copper, of the which they can increase the brilliancy in dipping it in the sulphuric acid, into which they have put a little suet; they can thus polish and burnish this Copper, absolutely the same as if it was solid.

CONCLUDING REMARKS.

Certainly it is very important to know the temperature of the zinc Bath, and to know the temperature that is suitable for every article, either too hot or too cold, is bad. There is yet another important question to be strictly attended to. We can easily ascertain what is the strength of the acid Baths, but although that is a thing quite simple, it is much more important, to discover the exact time, that the articles ought to remain in these Baths; to be cleansed of the outer surface or Oxyde; and it is of an immense importance; if these articles are of a delicate nature; as for example steel stay Busks: every quarter of an hour, that the articles remain in the acid Bath, longer than is absolutely necessary to cleanse off the outer surface; is every quarter of an hour, given to the detriment of the quality of the articles: as the acids commence to corrode the substance of the metal, after the surface; and although these things go unregarded in an establishment which is very badly managed, *like the one at Paris;* yet to a vigilant and careful manager everything of this kind will be strictly noticed, and even shades of difference strictly attended to, according to the Nature, the Strength, or Delicacy of the articles.

It is quite easy to conceive that an article of great Bulk, and strongly made; although left in the acid for too long a time, will naturally, resist better, than another article of a slighter make. The error is not so quickly discovered in the first; and in some cases is never found out, whilst in the latter the error is fatal: I will give an example that occurred to myself; in some Steel Stay Busks I had galvanised, the first two times they were properly done, and appeared to have preserved the temper of the Steel admirably, so I was encouraged to try a third quantity of the same article; in the which I was wofully disappointed; for these Busks having been left through gross carelessness and ignorance for too long a time in the acid, they were absolutely good for nothing, entirely spoiled, the tempering quite gone.

It is necessary to examine the articles from time to time, and likewise as much as possible to keep the acid Bath at the same strength, it would be well to test it every morning before commencing, with the instrument for testing acids.

Certainly, in a new discovery like this, there is reason in trying to make improvements, let each one who wishes to galvanise Iron make their own observations, their own experience, it is the only sure way never to be mistaken.

To galvanise Iron is a thing very simple, and extremely easy to do, yet some will always do it better than others, this is the natural and legitimate reward of skill and attention.

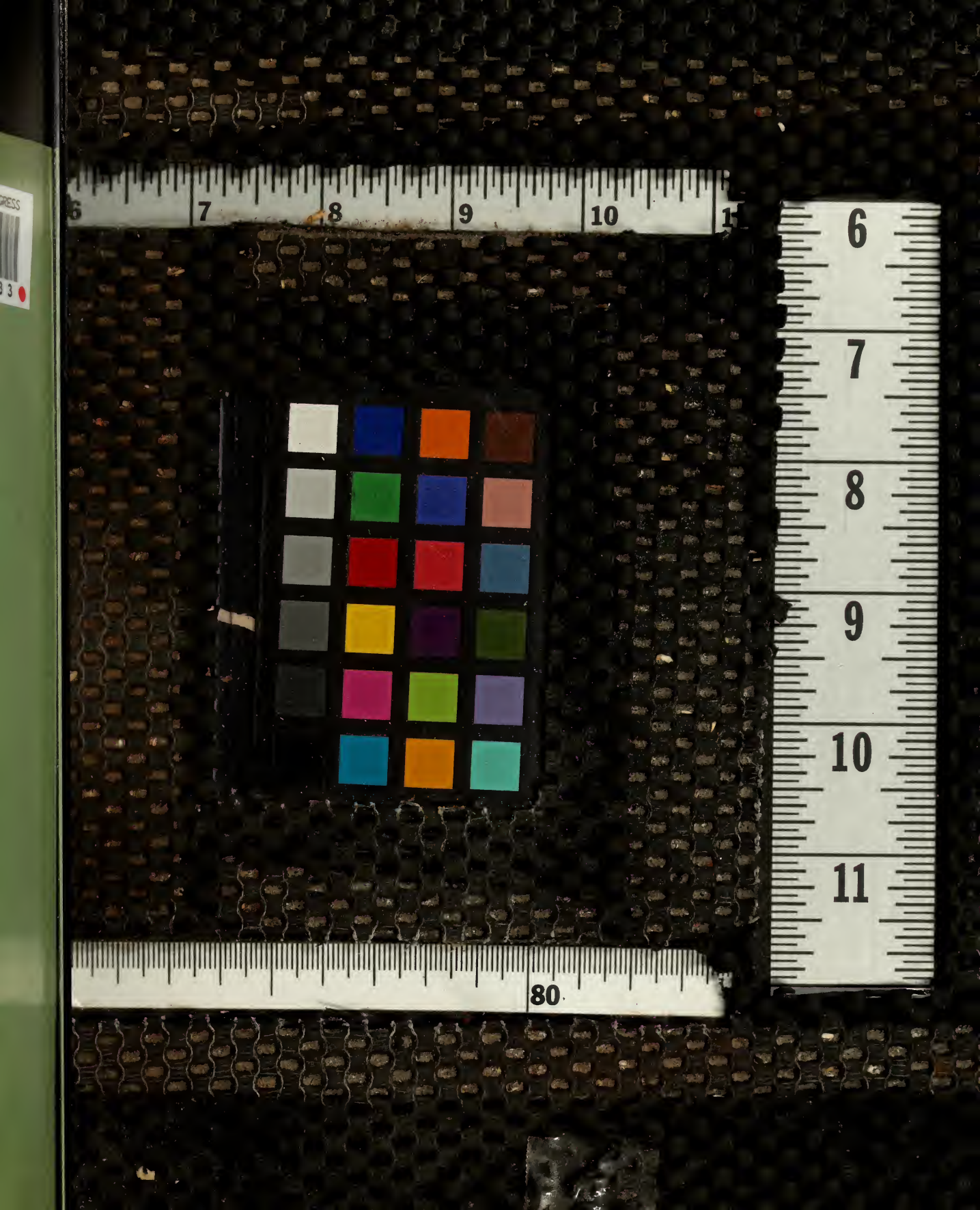
As it is necessary that the articles should be washed in water after coming out of the Zinc Bath, to cleanse them from the blackish stains caused by the muriatic salt: it is likewise necessary that this water should be warm; and not promiscuously thrown into the cold water, whether it is Winter or Summer, *as they do in Paris;* every one's reason will tell them, that to throw an article into cold water in Winter, immediately it comes out of the nearly red hot Zinc, must harden it, must give a kind of tempering to the articles, must render them more brittle: To obviate this great inconvenience; the simple remedy is to heat the water to about 100 degrees of Farenheit: more particularly in Winter.

Then, there is another consideration: as the polishing and cleansing the articles from the stains caused by the muriatic salt, is not equally important for all articles; and as those articles which do not go through this operation can be sold cheaper, without being any worse for use; it would be more economical, to be content with simply washing those articles that do not require polishing; as for example, the sheets of iron destined for roofing of buildings, &c. but to meet every taste, and obviate every objection, it would be easy to keep on hand, some which had been polished, and others which had been merely passed through the hot water, and to regulate the price accordingly.

Thus, the manufacturer could offer to his customers the articles which look more beautiful, without being any better, at a price proportionly higher according to the labour bestowed upon them, and the other articles not so beautiful to look at, but equally good for use, at an inferior price; and each one could then please themselves; of course some articles must be properly and thoroughly cleansed from all the stains, to be able, to be offered in competition, with other articles, which have not had the advantage of being galvanised.

GEORGE JOHNSON.

Paris, 29th July, 1841.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